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U.S. DEPARTMENT of TRANSPORTATION

Federal Aviation Administration

Interface Requirements Document (DRAFT)

National Airspace System (NAS) Voice System (NVS) to
FAA Facility Power

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INTERFACE REQUIREMENTS DOCUMENTS
APPROVAL SIGNATURE PAGE

National Airspace System (NAS) Voice System (NVS) to FAA Facility Power

APPROVAL SIGNATURES		
PARTICIPANT	NAME	DATE
[Organization]	[Person]	[Date]

REVISION RECORD

REVISION LETTER	DESCRIPTION	DATE	ENTERED BY

TABLE OF CONTENTS

Paragraph **Title** **Page**

LIST OF FIGURES

LIST OF TABLES

1. SCOPE

1.1 Summary

This Interface Requirements Document (IRD) was prepared in accordance with the standards and requirements contained in FAA-STD-025 and FAA-STD-067. This IRD describes the interface requirements between the National Airspace System (NAS) Voice System (NVS) and the FAA Facility Power at En Route, Terminal, and Remote Radio Facilities.

The contractor (vendor) will capture the NVS to FAA Facility Power interface design characteristics in the Interface Control Document (ICD).

Section 2 lists the reference documents used in developing this IRD.

Section 3 defines the interfaces in terms of their general, functional, and physical characteristics.

Section 4 defines the Quality Assurance provisions for this IRD.

Section 5, Preparation for delivery, is not applicable in this IRD.

Section 6, Notes, contains definitions, abbreviations and acronyms used in this IRD.

1.2 Subsystem Responsibility List

Table 1-1 lists the applicable facility equipment with which the NVS will interface.

TABLE 1-1 Subsystem Equipment Responsibility

Subsystem/Equipment	Common Name	Responsible Organization
NVS	NAS Voice System	AJW-92
	FAA En Route Facility Power	AJE
	FAA Terminal Facility Power	AJT
	FAA Remote Radio Facility Power	

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2. APPLICABLE DOCUMENTS

The following documents form a part of this IRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this IRD, the contents of this IRD **must** be the superseding requirements.

2.1 Government Documents

2.1.1 Federal Aviation Administration

2.1.1.1 Standards

FAA-STD-019e	Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment, December 22, 2005
FAA-STD-025f	Preparation of Interface Documentation, November 30, 2007
FAA-STD-067	Preparation of Specifications December 4, 2009

2.1.1.2 Handbooks

None

2.1.1.3 Specifications:

FAA-E-2731G	Voice Switching and Control System, Attachment J-3, Product Specification, with SCN PSR-016 July 2, 1998
FAA-E-ICS	Federal Aviation Administration Specification, Integrated Communication System (ICS), May 19, 2008
FAA-E-XXXX	Federal Aviation Administration Procurement Specification, National Airspace System (NAS) Voice System (NVS), Draft
FAA-E-XXXX	Federal Aviation Administration Specification, Radio Control Equipment (RCE), June 5, 2009
FAA-G-2100H	Federal Aviation Administration Specification, Electronic Equipment, General Requirements, May 9, 2005

2.1.1.4 FAA Orders

None

2.1.1.5 Other FAA Documents

HDDD-HWCI-7	System Interconnect Subsystem (SIS) Hardware Detailed Design Document for the Voice Switching and Control System (VSCS), November 2, 1998
NAS-IC-80104201	VSCS to AC Power Supply Interface Control Document for the Voice Switching and Control System (VSCS), March 28, 2001
NAS-IR-80104201	Voice Switching and Control System/ AC Power Supply Interface Control Document, Revision E May 1, 1996

2.1.2 Military Standards:

None

2.2 Non-Government Documents

2.2.1 Standards

None

2.2.2 Specifications

None

2.2.3 Other Publications:

2.2.3.1 National Fire Protection Association (NFPA):

NFPA-70	National Fire Protection Association National Electrical Code® **[Document not on file]** 2011

2.3 Document Sources

2.3.1 Source of FAA Documents

Copies of FAA specifications, standards, and publications may be obtained from the contracting officer, Federal Aviation Administration, 800 Independence Ave., S.W., Washington, DC 20591. Requests should clearly identify the desired material by number and date, and state the intended use of the material.

2.3.2 Source of NFPA Documents

Copies of NPFA documents may be obtained from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269, tel. (800) 344-3555.

3. INTERFACE REQUIREMENTS

This IRD describes the interfaces between the NVS and the FAA Facility Power. The NVS will be provided with either conditioned or unconditioned (commercial) alternating current (AC) power as applicable at Air Traffic Control (ATC) Facilities. The NVS may also receive direct current (DC) power at remote ATC facilities. The power provided to the NVS can vary by facility type. The AC power will be 120 volts AC (VAC), 208 VAC, or 240 VAC, depending on the power sources installed at the particular facility. The Remote Radio Facilities will be provided with either 120 VAC Power, 24 volts DC (VDC) power, or both AC and DC power depending on which power sources are installed. Currently the power requirements and location for the NVS Management System (NVSMS) are undefined and as such the specific requirements for the NVSMS are currently **TBD**.

The En Route and Terminal Facilities are defined as containing ATC Voice Nodes (AVNs). Remote Radio Facilities are defined as containing Remote Radio Nodes (RRNs). The NVS is defined as having common requirements that are applicable to the AVN, the RRN, and the NVSMS.

3.1 General Requirements

The following paragraphs define the general requirements for the NVS to FAA Facility Power interface.

3.1.1 FAA En Route and Terminal Facility Power Interfaces

The AVN to FAA En Route and Terminal Facility Power interfaces will consist of FAA-provided AC power. Both the FAA En Route and Terminal Facilities will be expected to supply dual AC power distribution feeds (i.e., Feed A and Feed B) to the NVS equipment as illustrated in Figure 3-1.

a. The AVN **must** connect to the FAA En Route Facility Power interface in a dual AC busing arrangement (Feed A and Feed B) as illustrated in Figure 3-1.

b. The AVN **must** connect to the FAA Terminal Facility Power interface in a dual AC busing arrangement (Feed A and Feed B) as illustrated in Figure 3-1.

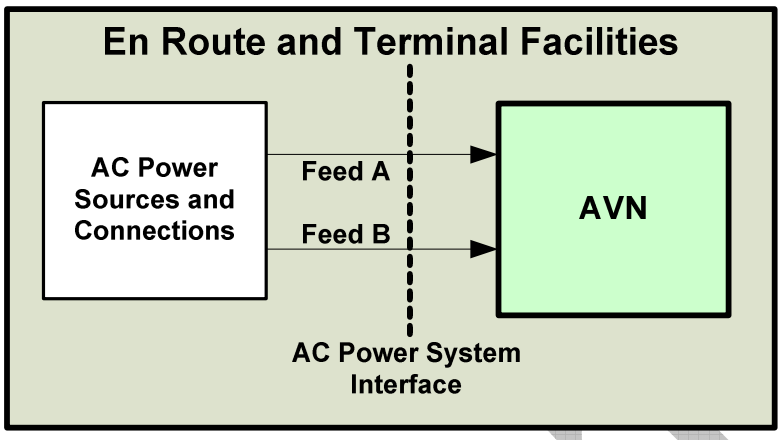

FIGURE 3-1 En Route and Terminal Facility AC Power Functional Connectivity

3.1.2 FAA Remote Radio Facility Power Interface

The RRN to FAA Remote Radio Facility power interface will consist of FAA-provided AC power and DC power. The FAA Remote Radio Facility may supply both AC and DC power feeds to the RRN equipment located at the remote site as illustrated in Figure 3-2. Not all remote sites will have both AC and DC power feeds.

a. The RRN **must** connect to the FAA Remote Radio Facility Power interface in a single AC busing arrangement (AC Feed), where AC power feeds are available, as illustrated in Figure 3-2.

b. The RRN **must** connect to the FAA Remote Radio Facility Power interface in a single DC busing arrangement (DC Feed), where DC power feeds are available, as illustrated in Figure 3-2.

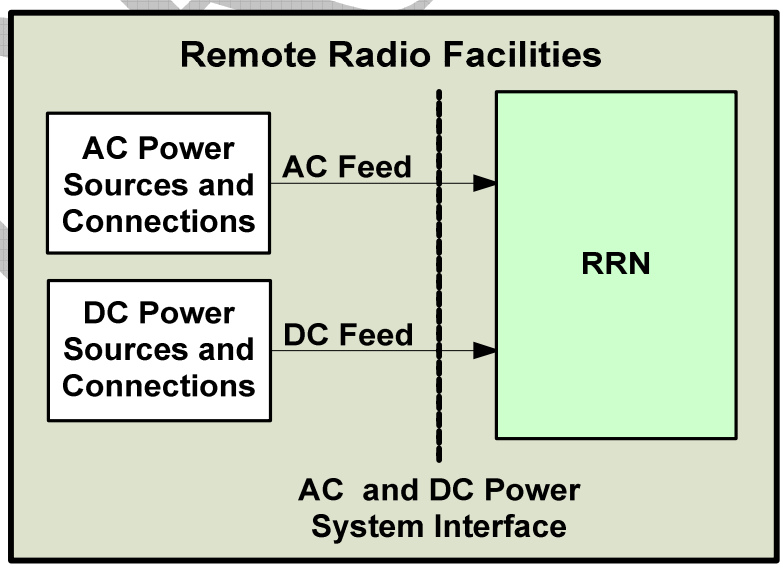

FIGURE 3-2 Remote Radio Facility AC and DC Power Functional Connectivity

3.1.3 NVS Management System Power Interface

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3.1.4 Interface Connectivity

The NVS will rely on FAA supplied facility power for its operations as defined in Sections 3.1.1 through 3.1.3.

a. The NVS **must** provide interface connectors and cabling that provide connection from the NVS equipment to the FAA Facility power feeds.

b. The NVS **must** connect to the government provided primary power sources in accordance with FAA-G-2100, paragraphs 3.1.1.1.1.b.(2), d, and e.

3.1.5 Power Utilization

a. The NVS **must** utilize facility power in accordance with NFPA-70.

b. The NVS **must** be capable of operating from conditioned AC power.

c. The NVS **must** be capable of operating from unconditioned (commercial) AC power.

d. The RRN **must** be capable of operating from DC power where available.

3.1.5.1 Power Utilization at En Route and Terminal Facilities

This section provides the power utilization requirements at En Route and Terminal Facilities as illustrated in Figure 3-1. The NVS equipment located at En Route and Terminal Facilities will have the capability to operate utilizing dual AC power feeds.

a. The AVN **must** have the capability to utilize power simultaneously from two separate AC power feeds at En Route Facilities.

b. The AVN **must** continue to operate when AC power is interrupted from any one AC power feed at En Route Facilities.

c. The AVN **must** have the capability to utilize power simultaneously from two separate AC power feeds at Terminal Facilities.

d. The AVN **must** continue to operate when AC power is interrupted from any one AC power feed at Terminal Facilities.

3.1.5.2 Power Utilization at Remote Radio Facilities

This section provides the power utilization requirements at Remote Radio Facilities possibly containing both AC and DC power feeds as illustrated in Figure 3-2. Not all remote sites will have both an AC power feed and a DC power feed. Where both feeds are present, the RRN equipment will have the capability to operate utilizing either the AC power feed or the DC power feed.

a. The RRN **must** have the capability to utilize power from the AC Feed at Remote Radio Facilities.

b. The RRN **must** have the capability to utilize power from the DC Feed at Remote Radio Facilities.

c. The RRN **must** have the capability to utilize power from both the AC Feed and the DC Feed simultaneously at Remote Radio Facilities where both AC and DC power feeds are provided.

d. The RRN **must** continue to operate utilizing the AC Feed when the DC Feed is interrupted at Remote Radio Facilities where both AC and DC power feeds are provided.

e. The RRN **must** continue to operate utilizing the DC Feed when the AC Feed is interrupted at Remote Radio Facilities where both AC and DC power feeds are provided.

3.1.5.3 Power Utilization at NVS Management System

RESERVED

3.2 Functional Requirements

There are no functional requirements for the NVS to FAA Facility Power interface identified in this IRD. This interface is primarily an electrical and mechanical interface. The key characteristics for the interface are specified in subsection 3.3.1.

3.2.1 Analog-type Interface Requirements

Not applicable in this IRD.

3.2.2 Discrete-type Interface Requirements

Not applicable in this IRD.

3.2.3 OSI-type (data) Interface Requirements

The NVS to FAA Facility Power interfaces described herein are electrical and mechanical interfaces, so the seven-layer model of the International Organization for Standardization (ISO)/Open Systems Interconnection (OSI) seven-layer model is not applicable to this IRD.

3.3 Physical Requirements

The requirements specified in this section are described in accordance with FAA-G-2100.

3.3.1 Electrical Power/Electronic Requirements

3.3.1.1 Connectors

a. The NVS **must** comply with the removable parts and mating connector requirements in accordance with FAA-G-2100, paragraph 3.1.2.1, for all interconnections at the power feed interfaces.

b. The NVS **must** comply with the electrical connector requirements in accordance with FAA-G-2100, paragraph 3.3.1.4.3, for all interconnections at the power feed interfaces.

c. The NVS **must** comply with the electrical connector safety requirements in accordance with FAA-G-2100, paragraph 3.3.5.1.12, for all interconnections at the power feed interfaces.

d. The NVS **must** comply with the mechanical interconnection requirements in accordance with FAA-G-2100, paragraph 3.3.5.4.1, for all interconnection at the power feed interfaces.

e. The NVS **must** use twist-lock type, three-conductor, four-wire connectors on all critical AC power connector drop cords at the source end connections.

f. The NVS **must** use general utility type, polarized standard three-conductor connectors for all non-critical AC electrical interfaces.

g. The NVS **must** use general utility type, polarized standard two-conductor connectors for all DC electrical interfaces.

h. The NVS **must** ensure that connectors on the power cords are different for each voltage and current rating in accordance with NFPA-70.

3.3.1.2 Wire/Cable

The cable length for power cords will be specified during installation. Connectors for power cords are discussed in 3.3.1.1.

a. The NVS **must** comply with the wiring requirements for electrical interfaces in accordance with FAA-G-2100, paragraph 3.3.1.4.10.

b. The NVS **must** utilize stranded power cords for connection to FAA AC power source interfaces in accordance with the NFPA-70 the sizing requirements.

c. The RRN **must** utilize stranded power cords for connection to FAA DC power source interfaces in accordance with the NFPA-70 sizing requirements.

d. The NVS **must** ensure that each set of power cords designed for a unique voltage or current is assigned the same part number with a dash number to identify length requirements.

e. The NVS **must** ensure that each set of power cords with common part numbers is interchangeable with any other power cord in that set.

3.3.1.2.1 Markings

a. The NVS **must** comply with the marking requirements at the power feed interfaces in accordance with FAA-G-2100, paragraphs 3.3.1.4.10.2 and 3.3.3.2.

b. The NVS **must** ensure that all cable connectors furnished on the equipment for making external connections are clearly identified on the plug-in side by labels descriptive of their specific function and by the proper reference designation, to include identification of specific panel and breaker.

3.3.1.3 Interface Wiring

Interface wiring diagrams are not used to impose requirements in this IRD but will be specified in the corresponding vendor ICD.

3.3.1.4 Electrical Power/Electronic Referencing (Grounding)

a. The NVS **must** comply with the ground potential requirements for all facility power feed interfaces in accordance with FAA-G-2100, paragraphs 3.3.5.1.1.a/b.

b. The NVS **must** ensure that all the NVS equipment connected to facility power feed interfaces are tied into the facility safety ground.

3.3.1.5 Fasteners

a. The NVS **must** comply with the hardware requirements for all power source connector fasteners in accordance with FAA-G-2100, paragraph 3.3.1.5.3.

3.3.1.6 Electromagnetic Compatibility

a. The NVS **must** comply with the electromagnetic compatibility requirements for all FAA Facility Power interfaces in accordance with FAA-G-2100, paragraph 3.3.2.d.

3.3.1.7 General Power Characteristics

The following sections describe the facility power operating voltage characteristics, frequency characteristics, current characteristics, transients, maximum power/power factor, surge protection, and harmonic distortion requirements for FAA Facilities.

3.3.1.7.1 Operating Voltage Characteristics

3.3.1.7.1.1 Operating Voltage Characteristics at En Route Facilities

a. The AVN **must** have the capability to utilize a combination of 120 volt-alternating current (VAC) and 208 VAC voltages supplied by the En Route Facility power sources.

b. The AVN **must** ensure that En Route Facility equipment requiring 208 VAC will operate on 208 VAC +10 / -15 percent, three-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.

c. The AVN **must** ensure that En Route Facility equipment requiring 120 VAC will operate on 120 VAC +10 / -15 percent, single-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.

3.3.1.7.1.2 Operating Voltage Characteristics at Terminal Facilities

a. The AVN **must** have the capability to utilize a combination of 120 VAC, 208 VAC, and 240 VAC voltages supplied by the Terminal Facility power sources.

b. The AVN **must** ensure that Terminal Facility equipment requiring 208 VAC will operate on 208 VAC +10 / -15 percent, three-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.

c. The AVN **must** ensure that Terminal Facility equipment requiring 240 VAC will operate on 240 VAC +10 / -15 percent, single-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.

d. The AVN **must** ensure that Terminal Facility equipment requiring 120 VAC will operate on 120 VAC +10 / -15 percent, single-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.

3.3.1.7.1.3 Operating Voltage Characteristics at Remote Radio Facilities

a. The RRN **must** have the capability to utilize a combination of 120 VAC and 24 Volts-direct current (VDC) voltages supplied by the Remote Radio Facility power sources, when available.

b. The RRN **must** ensure that Remote Radio Facility equipment requiring 120 VAC will operate on 120 VAC +10 / -15 percent, single-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.

c. The RRN **must** ensure that Remote Radio Facility equipment requiring 24 VDC will operate on 24 VDC +/- 20 percent, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.

3.3.1.7.1.4 Operating Voltage Characteristics at NVS Management System

RESERVED

3.3.1.7.2 Frequency Characteristics

a. The NVS **must** utilize FAA Facility AC power with a frequency characteristic of 60 Hz +/- 5 percent in accordance with FAA-G-2100, paragraph 3.1.1.7.c.

3.3.1.7.3 Current Characteristics

3.3.1.7.3.1 Current Characteristics at En Route Facilities

a. The AVN **must** limit AC power drawn from any one circuit breaker within the En Route Facility power distribution system to **TBD** amps at 208 VAC.

b. The AVN **must** limit AC power drawn from any one circuit breaker within the En Route Facility power distribution system to **TBD** amps at 120 VAC.

3.3.1.7.3.2 Current Characteristics at Terminal Facilities

a. The AVN **must** limit AC power drawn from any one circuit breaker within the Terminal Facility power distribution system to **TBD** amps at 208 VAC.

b. The AVN **must** limit AC power drawn from any one circuit breaker within the Terminal Facility power distribution system to **TBD** amps at 240 VAC.

c. The AVN **must** limit AC power drawn from any one circuit breaker within the Terminal Facility power distribution system to **TBD** amps at 120 VAC.

3.3.1.7.3.3 Current Characteristics at Remote Radio Facilities

a. The RRN **must** limit AC power drawn from any one circuit breaker within the Remote Radio Facility power distribution system to **TBD** amps at 120 VAC.

b. The RRN **must** limit DC power drawn from any one circuit breaker within the Remote Radio Facility power distribution system to **TBD** amps at 24 VDC.

3.3.1.7.3.4 Current Characteristics at NVS Management System

RESERVED

3.3.1.7.4 Transients

a. The NVS **must** meet the transient requirements for FAA Facility power sources in accordance with FAA-G-2100, paragraphs 3.1.1.6.f and 3.1.1.10.a.

3.3.1.7.5 Power Factor

a. The NVS **must** meet the power factor requirements for FAA Facility power sources in accordance with FAA-G-2100, paragraph 3.1.1.3.1.

3.3.1.7.5.1 Power Factor at En Route Facilities

a. The AVN **must** present greater than or equal to 0.85 lagging power factor to the FAA supplied power when operating under steady-state conditions at En Route Facilities.

3.3.1.7.5.2 Power Factor at Terminal Facilities

RESERVED

3.3.1.7.5.3 Power Factor at Remote Radio Facilities

a. The RRN **must** present a power factor to the AC power source that is greater than or equal to 0.85 leading or lagging when operating under steady-state conditions, from 25 to 100 percent of full load at the nominal line voltage at Remote Radio Facilities.

3.3.1.7.5.4 Power Factor at NVS Management System

RESERVED

3.3.1.7.6 Surge Protection

a. The NVS **must** provide active transient protection on AC lines in accordance with FAA-STD-019, paragraph 4.2.2.

3.3.1.7.7 Harmonic Distortion Effect of Equipment on Power Source

a. The NVS **must** meet the requirements for input current harmonic distortion for FAA Facility power sources in accordance with FAA-G-2100, paragraph 3.1.1.5, Table I.

b. The NVS **must** produce a total harmonic content of the input voltage received by the NVS, fed back into the FAA Facility power sources, that is less than or equal to 10 percent of the fundamental 60 Hz frequency in accordance with FAA-G-2100, paragraph 3.1.1.7.d.

c. The NVS **must** produce single harmonic content of the input voltage received by the NVS, fed back into the FAA Facility power sources, that is less than or equal to 3 percent of the fundamental 60 Hz frequency in accordance with FAA-G-2100, paragraph 3.1.1.7.d.

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4. QUALITY ASSURANCE PROVISIONS

Compliance with the requirements stated in this IRD are deemed met when all the requirements specified in a paragraph are verified by one or more of the methods outlined in the subsequent subparagraphs. The results of the verification activities **must** be expressed as either pass or fail.

4.1 General

Interface requirements imposed by section 3 of this IRD **must** be verified by use of the verification methods specified in paragraph 4.5.2 and at the verification levels (phases) specified in paragraph 4.5.1. Verification methods and levels **must** be applied in accordance with Table 4-1, Verification Requirements Traceability Matrix (VRTM).

4.2 Responsibility for Verification

The program manager for the NVS equipment has the responsibility for the interface requirements verification. The program manager for the legacy equipment will assist in the verification.

4.3 Special Verification Requirements

This IRD imposes no special test equipment requirements.

4.4 Verification Requirements Traceability Matrix

Verification **must** be in accordance with Table 4-1, Verification Requirements Traceability Matrix (VRTM).

TABLE 4-1 Verification Requirements Traceability Matrix

(Verification Methods: D - Demonstration, I - Inspection, A - Analysis, T - Test, X - Not Applicable)

Section 3	Requirements	Verification Phase and Method			
		Subsystem Level	Integration Level	Site Level	Remarks
3.1.1.a	The AVN **must** connect to the FAA En Route Facility Power interface in a dual AC busing arrangement (Feed A and Feed B) as illustrated in Figure 3-1.	T	T	X	
3.1.1.b	The AVN **must** connect to the FAA Terminal Facility Power interface in a dual AC busing arrangement (Feed A and Feed B) as illustrated in Figure 3-1.	T	T	X	
3.1.2.a	The RRN **must** connect to the FAA Remote Radio Facility Power interface in a single AC busing arrangement (AC Feed), where AC power feeds are available as illustrated in Figure 3-3.	T	T	X	

Section 3	Requirements	Verification Phase and Method			
		Subsystem Level	Integration Level	Site Level	Remarks
3.1.2.b	The RRN **must** connect to the FAA Remote Radio Facility Power interface in a single DC busing arrangement (DC Feed), where DC power feeds are available as illustrated in Figure 3-3.	T	T	X	
3.1.3	**RESERVED**				
3.1.4.a	The NVS **must** provide interface connectors and cabling that provide connection from the NVS equipment to the FAA Facility power feeds.	I	I	X	
3.1.4.b	The NVS **must** connect to the government provided primary power sources in accordance with FAA-G-2100, paragraphs 3.1.1.1.1.b.(2), d, and e.	I	I	X	
3.1.5.a	The NVS **must** utilize facility power in accordance with NFPA-70.	I	I	X	
3.1.5.b	The NVS **must** be capable of operating from conditioned AC power.	I	I	X	
3.1.5.c	The NVS **must** be capable of operating from unconditioned (commercial) AC power.	I	I	X	
3.1.5.d	The RRN **must** be capable of operating from DC power when available.	I	I	X	
3.1.5.1.a	The AVN **must** have the capability to utilize power simultaneously from two separate AC power feeds at En Route Facilities.	T	T	X	
3.1.5.1.b	The AVN **must** continue to operate when AC power is interrupted from any one AC power feed at En Route Facilities.	D	D	X	
3.1.5.1.c	The AVN **must** have the capability to utilize power simultaneously from two separate AC power feeds at Terminal Facilities.	T	T	X	
3.1.5.1.d	The AVN **must** continue to operate when AC power is interrupted from any one AC power feed at Terminal Facilities.	D	D	X	
3.1.5.2.a	The RRN **must** have the capability to utilize power the AC Feed at Remote Radio Facilities.	T	T	X	
3.1.5.2.b	The RRN **must** have the capability to utilize power the DC Feed at Remote Radio Facilities.	T	T	X	

Section 3	Requirements	Verification Phase and Method			
		Subsystem Level	Integration Level	Site Level	Remarks
3.1.5.2.c	The RRN **must** have the capability to utilize power from both the AC Feed and the DC Feed simultaneously at Remote Radio Facilities where both AC and DC power feeds are provided.	D	D	X	
3.1.5.2.d	The RRN **must** continue to operate utilizing the AC Feed when the DC Feed is interrupted at Remote Radio Facilities where both AC and DC power feeds are provided.	D	D	X	
3.1.5.2.e	The RRN **must** continue to operate utilizing the DC Feed when the AC Feed is interrupted at Remote Radio Facilities where both AC and DC power feeds are provided.	D	D	X	
3.1.5.3	**RESERVED**				
3.3.1.1.a	The NVS **must** comply with the removable parts and mating connector requirements in accordance with FAA-G-2100, paragraph 3.1.2.1, for all interconnections at the power feed interfaces.	I	I	X	
3.3.1.1.b	The NVS **must** comply with the electrical connector requirements in accordance with FAA-G-2100, paragraph 3.3.1.4.3, for all interconnections at the power feed interfaces.	I	I	X	
3.3.1.1.c	The NVS **must** comply with the electrical connector safety requirements in accordance with FAA-G-2100, paragraph 3.3.5.1.12, for all interconnections at the power feed interfaces.	I	I	X	
3.3.1.1.d	The NVS **must** comply with the mechanical interconnection requirements in accordance with FAA-G-2100, paragraph 3.3.5.4.1, for all interconnection at the power feed interfaces.	I	I	X	
3.3.1.1.e	The NVS **must** use twist-lock type, three-conductor, four-wire connectors on all critical AC power connector drop cords at the source end connections.	I	I	X	
3.3.1.1.f	The NVS **must** use general utility type, polarized standard three-conductor connectors for all non-critical AC electrical interfaces.	I	I	X	

Section 3	Requirements	Verification Phase and Method			
		Subsystem Level	Integration Level	Site Level	Remarks
3.3.1.1.g	The NVS **must** use general utility type, polarized standard two-conductor connectors for all non-critical DC electrical interfaces.	I	I	X	
3.3.1.1.h	The NVS **must** ensure that connectors on the power cords are different for each voltage and current rating in accordance with NFPA-70.	I	I	X	
3.3.1.2.a	The NVS **must** comply with the wiring requirements for electrical interfaces in accordance with FAA-G-2100, paragraph 3.3.1.4.10,	I	I	X	
3.3.1.2.b	The NVS **must** utilize stranded power cords for connection to FAA AC power source interfaces in accordance with the NFPA-70 sizing requirements.	I	I	X	
3.3.1.2.c	The RRN **must** utilize stranded power cords for connection to FAA DC power source interfaces in accordance with the NFPA-70 sizing requirements.	I	I	X	
3.3.1.2.d	The NVS **must** ensure that each set of power cords designed for a unique voltage or current is assigned the same part number with a dash number to identify length requirements.	I	I	X	
3.3.1.2.e	The NVS **must** ensure that each set of power cords with common part numbers is interchangeable with any other cord in that set.	D	D	X	
3.3.1.2.1.a	The NVS **must** comply with the marking requirements at the power feed interfaces in accordance with FAA-G-2100, paragraphs 3.3.1.4.10.2 and 3.3.3.2.	I	I	X	
3.3.1.2.1.b	The NVS **must** ensure that all cable connectors furnished on the equipment for making external connections are clearly identified on the plug-in side by labels descriptive of their specific function and by the proper reference designation, to include identification of specific panel and breaker.	I	I	X	

Section 3	Requirements	Verification Phase and Method			
		Subsystem Level	Integration Level	Site Level	Remarks
3.3.1.4.a	The NVS **must** comply with the ground potential requirements for all facility power feed interfaces in accordance with FAA-G-2100, paragraphs 3.3.5.1.1.a/b.	I, T	I, T	X	
3.3.1.4.b	The NVS **must** ensure that all the NVS equipment connected to facility power feed interfaces are tied into the facility safety ground.	I, T	I, T	X	
3.3.1.5.a	The NVS **must** comply with the hardware requirements for all power source connector fasteners in accordance with FAA-G-2100, paragraph 3.3.1.5.3.	I, T	I, T	X	
3.3.1.6.a	The NVS **must** comply with the electromagnetic compatibility requirements for all FAA Facility power interfaces in accordance with FAA-G-2100, paragraph 3.3.2.d.	I, T	I, T	X	
3.3.1.7.1.1.a	The AVN **must** have the capability to utilize a combination of 120 volt-alternating current (VAC) and 208 VAC voltages supplied by the En Route Facility power sources.	T	T	X	
3.3.1.7.1.1.b	The AVN **must** ensure that En Route Facility equipment requiring 208 VAC will operate on 208 VAC +10 / -15 percent, two-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.	T	T	X	
3.3.1.7.1.1.c	The AVN **must** ensure that En Route Facility equipment requiring 120 VAC will operate on 120 VAC +10 / -15 percent, single-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.	T	T	X	
3.3.1.7.1.2.a	The AVN **must** have the capability to utilize a combination of 120 VAC, 208 VAC, and 240 VAC voltages supplied by the Terminal Facility power sources.	T	T	X	
3.3.1.7.1.2.b	The AVN **must** ensure that Terminal Facility equipment requiring 208 VAC will operate on 208 VAC +10 / -15 percent, three-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.	T	T	X	

Section 3	Requirements	Verification Phase and Method			
		Subsystem Level	Integration Level	Site Level	Remarks
3.3.1.7.1.2.c	The AVN **must** ensure that the Terminal Facility equipment requiring 240 VAC will operate on 240 VAC +10 / -15 percent, single-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.	T	T	X	
3.3.1.7.1.2.d	The AVN **must** ensure that Terminal Facility equipment requiring 120 VAC will operate on 120 VAC +10 / -15 percent, single-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.	T	T	X	
3.3.1.7.1.3.a	The RRN **must** have the capability to utilize a combination of 120 VAC and 24 VDC voltages supplied by the Remote Radio Facility power sources, when available.	T	T	X	
3.3.1.7.1.3.b	The RRN **must** ensure that Remote Radio Facility equipment requiring 120 VAC will operate on 120 VAC +10 / -15 percent, single-phase, four-wire, electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.	T	T	X	
3.3.1.7.1.3.c	The RRN **must** ensure that Remote Radio Facility equipment requiring 24 VDC will operate on 24 VDC +10 / -15 percent, DC electrical power in accordance with FAA-G-2100, paragraph 3.1.1.7.a.	T	T	X	
3.3.1.7.1.4	**RESERVED**				
3.3.1.7.2.a	The NVS **must** utilize FAA Facility AC power with a frequency characteristic of 60 Hz +/- 5 percent in accordance with FAA-G-2100, paragraph 3.1.1.7.c.	T	T	X	
3.3.1.7.3.1.a	The AVN **must** limit AC power drawn from any one circuit breaker with the En Route Facility power distribution system to **TBD** amps at 208 VAC.	I, T	I, T	X	
3.3.1.7.3.1.b	The AVN **must** limit AC power drawn from any one circuit breaker within the En Route Facility power distribution system to **TBD** amps at 120 VAC.	I, T	I, T	X	
3.3.1.7.3.2.a	The AVN **must** limit AC power drawn from any one circuit breaker within the Terminal Facility power distribution system to **TBD** amps at 208 VAC.	I, T	I, T	X	

Section 3	Requirements	Verification Phase and Method			
		Subsystem Level	Integration Level	Site Level	Remarks
3.3.1.7.3.2.b	The AVN **must** limit AC power drawn from any one circuit breaker within the Terminal Facility power distribution system to **TBD** amps at 240 VAC.	I, T	I, T	X	
3.3.1.7.3.2.c	The AVN **must** limit AC power drawn from any one circuit breaker within the Terminal Facility power distribution system to **TBD** amps at 120 VAC.	I, T	I, T	X	
3.3.1.7.3.3.a	The RRN **must** limit AC power drawn from any one circuit breaker within the Remote Radio Facility power distribution system to **TBD** amps at 120 VAC.	I, T	I, T	X	
3.3.1.7.3.3.b	The RRN **must** limit AC power drawn from any one circuit breaker within the Remote Radio Facility power distribution system to **TBD** amps at 24 VDC.	I, T	I, T	X	
3.3.1.7.3.4	**RESERVED**				
3.3.1.7.4	The NVS **must** meet the transient requirements for FAA Facility power sources in accordance with FAA-G-2100, paragraphs 3.1.1.6.f and 3.1.1.10.a.	I, T	I, T	X	
3.3.1.7.5	The NVS **must** meet the power factor requirements for FAA Facility power sources in accordance with FAA-G-2011, paragraph 3.1.1.3.1.	I, T	I, T	X	
3.3.1.7.5.1.a	The NVS AVN **must** present greater than or equal to 0.85 lagging power factor to the FAA-supplied power when operating under steady-state conditions at En Route Facilities.	T	T	X	
3.3.1.7.5.2	**RESERVED**				
3.3.1.7.5.3.a	The RRN **must** present a power factor to the AC power source that is greater than or equal to 0.85 leading or lagging when operating under steady-state conditions, from 25 to 100 percent of full load at the nominal line voltage at Remote Radio Facilities.	T	T	X	
3.3.1.7.5.4	**RESERVED**				
3.3.1.7.6.a	The NVS must provide active transient protection on AC lines in accordance with FAA-STD-019, paragraph 4.2.2.	I	I	X	

Section 3	Requirements	Verification Phase and Method			
		Subsystem Level	Integration Level	Site Level	Remarks
3.3.1.7.7.a	The NVS must meet the requirements for input current harmonic distortion for FAA Facility power sources in accordance with FAA-G-2100, paragraph 3.1.1.5, Table I.	I, T	I, T	X	
3.3.1.7.7.b	The NVS **must** produce a total harmonic content of the input voltage received by the NVS, fed back into the FAA Facility power sources, that is less than or equal to 10 percent of the fundamental 60 Hz frequency in accordance with FAA-G-2100, paragraph 3.1.1.7.d.	T	T	X	
3.3.1.7.7.c	The NVS **must** produce single harmonic content of the input voltage received by the NVS, fed back into the FAA Facility power sources, that is less than or equal to 3 percent of the fundamental 60 Hz frequency in accordance with FAA-G-2100, paragraph 3.1.1.7.d.	T	T	X	

4.5 Verification Levels and Methods

The levels and methods of verification appropriate for use in the VRTM, presented in Section 4 of the IRD, are defined in the following paragraphs.

4.5.1 Verification Levels

There are three verification levels that can be used during the verification process. Verification levels are:

a) Subsystem Level. This level of verification is usually accomplished at the contractor's facility and culminates in the formal acceptance of a contractual end-item.

b) Integration-level. This level of verification is conducted at the FAA Technical Center (FAATC), or at a key site. The verification conducted will determine if the hardware, software, or subsystem to be deployed for site installation will perform in a NAS environment and in accordance with NAS system-level operational and functional requirements.

c) Site-level. This level of verification is usually performed at the designated site. The verification portion of the subsystem installation and checkout will emphasize demonstration of the overall system performance requirements. It includes the demonstration of an end-item, subsystem and/or system, the final acceptance demonstrations, and commissioning activities.

4.5.2 Verification Methods

There are four verification methods that can be used at any of the three verification levels. Verification methods are:

a) Inspection. Inspection is a method of verification to determine compliance without the use of special test equipment, procedures, or services, and consist of a non-destructive static-state examination of the hardware, software, and/or the technical data and documentation.

b) Test. Test is a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance to the success criteria stipulated in the IRD or project specification. The process uses standardized laboratory equipment, procedures, hardware, and/or services.

c) Demonstration. Demonstration is a method of verification where qualitative determination of properties is made for configuration items, including software, and/or technical data and documentation measured, in a dynamic state.

d) Analysis. This method of verification consists of comparing hardware or software design with known scientific and technical principles, procedures, and practices to estimate the capability of the proposed design to meet the mission and system requirements. When certain elements of design are comprised of previously qualified elements such as commercial off the shelf (COTS) equipment, then analysis of previous qualification testing in meeting specification requirements may be used to reduce the amount of qualification testing.

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5. PREPARATION FOR DELIVERY

This section is not applicable to this IRD.

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6. NOTES

This section is used to describe the unique operational concept and provide additional detail to aid in understanding the NVS/AC Power Supply interface.

6.1 Definitions

Definitions of significant terms peculiar to this document follow:

Ampere (Amp): The basic International System (SI) unit measuring the quantity of electricity.

Analog Interface - A customized or specialized interface between two systems or **subsystem**s that uses **analog signal**s to transmit information.

Analog Signal - A nominally continuous electrical signal that varies in amplitude and / or phase frequency in response to changes in some quantity. Example: Microwave Communication, Primary Radar.

Circuit: A conductor or system of conductors through which an electrical current is intended to flow.

Conditioned Power: means that the facility Uninterruptible Power Supply (UPS) is functioning properly and is supplying power to the NVS**.**

Connectorized - The term "connectorized" is defined as being equipped with a connector.

Critical: functions or services that, if lost, would raise the risk associated with providing safe and efficient local NAS operations to an unacceptable level, to include exercising safe separation and control over aircraft.

Discrete Interface - A customized or specialized digital interface between two systems or subsystems. The discrete interface may not conform to any open system or network standards.

Facility - The total plant (e.g., building, structure, enclosure, assembly, Open-Air Plan "site") required for a subsystem/equipment item to function. The facilit**y** houses, supports, and protects the subsystem/equipment item. Facility characteristics are determined by the total complement of dependent subsystems/equipment items.

Feeder: A circuit, such as conductors in a conduit or a busbar run, which carries a large block of power from the service equipment to a sub-feeder panel or a branch circuit panel or to some point at which the block power is broken into smaller circuits.

Ground: A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Interface (I/F) - A common functional and/or physical boundary where hardware/software interact.

Interface Control Document (ICD) - The ICD is a formal agreement which documents how the interface requirements are implemented for interfaces between subsystems or a subsystem and its supporting facility. The purpose of an ICD is to control implementation of interface design requirements.

Interface Requirements Document (IRD) - The IRD is a formal agreement that establishes design requirements for interfaces between subsystems or a subsystem and its supporting facility. The purpose of an IRD is to impose interface design requirements.

National Airspace System (NAS): The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas.

NVS Console Equipment: The complement of the NVS position equipment consisting of the NVS position equipment consisting of the NVS position electronics box, the indirect access daypad and interactive display unit(s) (panel(s)).

Surge: An overvoltage or overcurrent of short duration occurring on a power line.

Transient: An overvoltage or overcurrent pulse on a power, signal, control, or data line.

Unconditioned (Commercial) Power: Unconditioned power is commercial power or FAA backup generator power that is not conditioned by the Uninterruptible Power Supply (UPS).

Uninterruptible Power Supply (UPS): An electrical apparatus that provides emergency AC power to a load for a certain period of time when the input power source, typically the utility mains, fails; also **uninterruptible power source**.

6.2 Abbreviations and Acronyms

Definitions of abbreviations and acronyms peculiar to this document follow:

AC	Alternating Current
ATC	Air Traffic Control
AVN	ATC Voice Node
COTS	Commercial off the shelf
DC	Direct Current
FAA	Federal Aviation Administration
FAATC	Federal Aviation Administration Technical Center
Hz	Hertz
ICD	Interface Control Document
IEEE	Institute of Electrical and Electronic Engineers
IRD	Interface requirements documents
ISO	International Organization for Standardization
NAS	National Airspace System
NEC	National Electric Code
NFPA	National Fire Protection Association
NVS	NAS Voice System
NVSMS	NVS Management System

OSI	Open System Interconnection
RRN	Remote Radio Node
UPS	Uninterruptible Power Supply; Uninterruptible Power Source
V	Volts
VAC	Volts-Alternating Current
VDC	Volts-Direct Current
VRTM	Verification Requirements Traceability Matrix

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